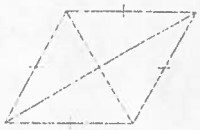
Key Concepts

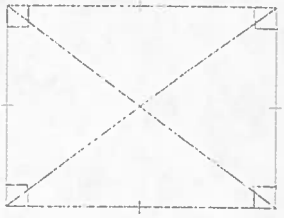
- The diagonals of a parallelogram bisect each other.
- Joining the midpoints of adjacent sides of any quadrilateral forms a parallelogram.
- The line segment joining the midpoints of the non-parallel sides of a trapezoid is parallel to the parallel sides and has a length equal to the mean of the lengths of the parallel sides.

Communicate Your Understanding

C1 Describe how you could fold a drawing to investigate the properties of the diagonals of a rhombus.



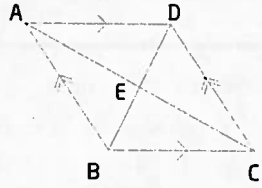
C2 Describe how you could use geometry software to investigate the properties of the diagonals of a rectangle.



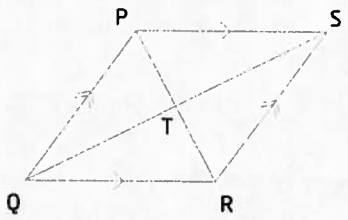
Practise

1. Which of the line segments inside each parallelogram are equal in length?

a)



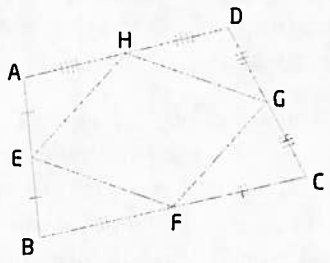
b)



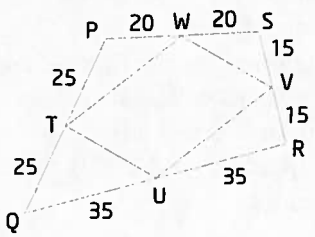
For help with questions 2 and 3, see Example 1.

2. Which of the line segments inside each quadrilateral are parallel?

a)



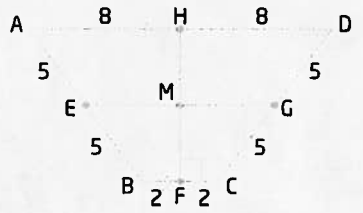
b)



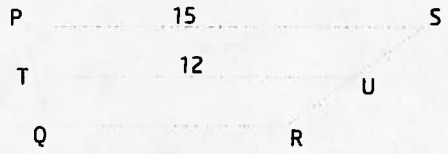
3. Which of the line segments inside each quadrilateral in question 2 are equal in length?

For help with questions 4 and 5, see Example 2.

4. **a)** Which line segments are parallel in the figure below?
   b) Find the length of EG.
   c) Find the length of FH.



5. Find the length of QR.



Connect and Apply

6. Fold a drawing of a square to investigate the properties of its diagonals. Describe your findings.

7. Describe how you can use geometry software to determine when the diagonals of a parallelogram are equal in length.

8. **a)** Draw two line segments, AC and BD, that bisect each other at right angles. Then, draw a quadrilateral that has AC and BD as its diagonals. Classify the quadrilateral. Justify this classification.
   b) Find the midpoints of AB, BC, CD, and DA, labelling these points E, F, G, and H, respectively. Draw line segments joining the midpoints of adjacent sides. Classify the quadrilateral EFGH. Justify this classification.

9. What properties make rectangles useful in the construction of buildings and other structures?

10. Sarah determines that the diagonals of a particular quadrilateral bisect each other and are equal in length. She concludes that the quadrilateral must be a square. Is Sarah correct? Explain your reasoning.

11. **a)** Investigate the properties of the diagonals of a rectangle. Describe your findings.
    b) Investigate the properties of the diagonals of a kite. Describe your findings.
    c) A rhombus is both a parallelogram and a kite. Make a conjecture about the properties of the diagonals of a rhombus.
    d) Describe how you could use geometry software to test your conjecture in part c).
    e) Make a table to summarize the properties of the diagonals of squares, rectangles, parallelograms, rhombi, and kites.

12. **a)** Predict the location of the balance point of a flat uniform rectangular object. Explain your reasoning.
    b) Describe how you could determine if your prediction is correct.

13. Use a rectangle to estimate the location of the geographical centre of Canada.
    a) Trace the outline of Canada from the map on page 115 onto a sheet of paper. Draw a rectangle on your outline to approximate the shape of Canada as closely as you can.
    b) Describe how to find the centre of this rectangle.
    c) Find the centre you described in part b). Then, find the town or city closest to this centre. Compare your estimate of the geographical centre of Canada with those made by your classmates.